

Appl. No. : 10/041,767
Filed : January 7, 2002

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1-17. (Canceled)

a1 18. (Currently amended) A printed circuit board drilling machine in combination with a printed circuit board, the drilling machine having a worktable for supporting the printed circuit board, a spindle, a drill bit and a controller configured to instruct the drilling machine to drill to a point in ~~a work-piece~~ the printed circuit board, to retract said drill bit a retract distance, said retract distance configured such that a tip end of said drill bit remains below a top surface of said printed circuit board ~~work-piece~~ and to drill a distance greater than said retract distance into said printed circuit board ~~work-piece~~.

19. (Original) The drilling machine of Claim 18, wherein said controller is further ~~configured to retract~~ said drill bit a retract distance and to drill to a distance greater than said retract distance ~~until a final depth is reached~~.

20. (Currently amended) The drilling machine of Claim 19, wherein said controller is further configured to completely withdraw said drill tip from said ~~work-piece~~ printed circuit board after said final depth is reached.

21. (Original) The drilling machine of Claim 18, wherein said controller is further configured to receive said retract distance from an operator.

22. (Original) The drilling machine of Claim 18, wherein said controller is further configured to calculate said retract distance from a set of operational data that is inputted into said controller by an operator.

23. (Original) The drilling machine of Claim 18, wherein said controller is further configured to receive data indicating a stack height and a number of increments from an operator and to calculate the retract height from said stack height and said number of increments.

24. (Original) The drilling machine of Claim 18, wherein said controller is further configured to receive data indicating a hole depth and a number of increments from an operator and to calculate the retract height from said hole depth and said number of increments.

25. (Currently amended) The drilling machine of Claim 18, wherein said controller is further configured to drill to a first depth in said ~~work-piece~~ printed circuit board and to completely withdraw said drill bit from said ~~work-piece~~ printed circuit board.

26. (Original) The drilling machine of Claim 18, wherein said controller is further configured to retract said drill bit a retract distance and to drill to a distance greater than said retract distance until a final depth is reached and said retract distance is uniform.

27. (Original) The drilling machine of Claim 18, wherein said controller is further configured to retract said drill bit a retract distance and to drill to a distance greater than said retract distance until a final depth is reached and said retract distance is non-uniform.

28. (Original) The drilling machine of Claim 18, wherein said controller is further configured to retract said drill bit a retract distance and to drill to a distance greater than said retract distance until a final depth is reached and said distance greater than said retract distance is uniform.

29. (Original) The drilling machine of Claim 18, wherein said controller is further configured to retract said drill bit a retract distance and to drill to a distance greater than said retract distance until a final depth is reached and said distance greater than said retract distance is non-uniform.

30. (Original) The drilling machine of Claim 18, wherein said controller is further configured to retract said drill bit a retract distance and to drill to a distance greater than said retract distance until a final depth is reached and said retract distance is uniform and said distance greater than said retract distance is uniform.

31. (Original) The drilling machine of Claim 18, wherein said controller is further configured such that to reduce an axial speed of the drill bit, while drilling a distance greater than said retract distance, from a first axial speed to a second axial speed when the drill bit when the drill bit passes a deceleration point.

32. (Original) The drilling machine of Claim 31, wherein said controller is further configured to receive the deceleration point and the first axial speed from an operator.

33. (Original) The drilling machine of Claim 32, wherein said controller is further configured to, while said drill bit is being retracted, reduce from a first axial speed to a second axial speed when the drill bit passes a deceleration point.

34. (Original) The drilling machine of Claim 33, wherein said controller is further configured to receive the deceleration point and the first axial speed from an operator.

35. (Currently amended) A method for operating a printed circuit board drilling machine having a worktable, a spindle, a drill bit and a controller configured to control the operation of the drilling machine, the method comprising the steps of:

positioning a printed circuit board on the worktable;

drilling to a point in the printed circuit board ~~a work piece~~;

retracting said drill bit a retract distance, said retract distance configured such that a tip end of said drill bit remains below a top surface of said printed circuit board ~~work piece~~,
~~piece,~~

drilling a distance greater than said retract distance into said printed circuit board ~~work piece~~.

36. (Original) The method of Claim 35, further including repeatedly retracting said drill bit a retract distance and drilling a distance greater than said retract distance until a final depth is reached.

37. (Currently amended) The method of Claim 36, further including completely withdrawing said drill tip from said ~~work piece~~ printed circuit board after said final depth is reached.

38. (Original) The method of Claim 35, further including receiving said retract distance from an operator.

39. (Original) The method of Claim 35, further including calculating said retract distance from a set of operational data that is inputted into said controller by an operator.

40. (Original) The method of Claim 35, further including receiving data indicating a stack height and a number of increments from an operator and configuring and calculating the retract height from said stack height and said number of increments.

41. (Original) The method of Claim 35, further including receiving data indicating a hole depth and a number of increments from an operator and calculating the retract height from said hole depth and said number of increments.

42. (Currently amended) The method of Claim 35, further comprising drilling to a first depth in said ~~work-piece~~ printed circuit board and completely withdrawing said drill bit from said ~~workpiece~~ printed circuit board.

a1 43. (Original) The method of Claim 35, further including retracting said drill bit a retract distance and drilling to a distance greater than said retract distance until a final depth is reached, wherein said retract distance is uniform.

44. (Original) The method of Claim 35, further including retracting said drill bit a retract distance and drilling to a distance greater than said retract distance until a final depth is reached, wherein said retract distance is non- uniform.

45. (Original) The method of Claim 35, further including retracting said drill bit a retract distance and drilling to a distance greater than said retract distance until a final depth is reached, wherein said distance greater than said retract distance is uniform.

46. (Original) The method of Claim 35, further including retracting said drill bit a retract distance and drilling to a distance greater than said retract distance until a final depth is reached, wherein said distance greater than said retract distance is non-uniform.

47. (Original) The method of Claim 35, further including retracting said drill bit a retract distance and drilling to a distance greater than said retract distance until a final depth is reached, wherein said retract distance is uniform and said distance greater than said retract distance is uniform.

48. (Original) The method of Claim 35, further comprising, while drilling a distance greater than said retract distance, reducing an axial speed of the drill bit from a first axial speed to a second axial speed when the drill bit passes a deceleration point.

49. (Original) The method of Claim 48, further comprising receiving the deceleration point and the first axial speed from an operator.

50. (Original) The method of Claim 35, further comprising, while retracting said drill bit, reducing an axial speed of the drill bit from a first axial speed to a second axial speed when the drill bit passes a deceleration point.

51. (Original) The method of Claim 50, further comprising receiving the deceleration point and the first axial speed from an operator.

52. (New) A method for operating a printed circuit board drilling machine having a worktable for supporting a plurality of circuit boards, a plurality of spindles each associated with a drill bit, and a controller configured to control the operation of the drilling machine, the method comprising the steps of:

a1 positioning the plurality of circuit boards on the work table such that each of the plurality of circuit boards is associated with a spindle and a drill bit;

drilling to a point within each of the plurality of printed circuit boards;

retracting said plurality of drill bits a retract distance, said retract distance configured such that a tip end of said plurality of drill bits remains below a top surface of each of said plurality of printed circuit boards,

drilling a distance greater than said retract distance into each of said plurality of printed circuit boards

retracting said plurality of drill bits a second retract distance, said second retract distance configured such that a tip end of said plurality of drill bits remains below a top surface of each of said plurality of printed circuit boards,

drilling a distance greater than said second retract distance into each of said plurality of printed circuit boards

retracting said plurality of drill bits a third retract distance, said third retract distance configured such that a tip end of said plurality of drill bits remains below a top surface of each of said plurality of printed circuit boards, and

drilling a distance greater than said third retract distance into each of said plurality of printed circuit boards.

53. (New) The method of Claim 52, further comprising moving each spindle and drill bit with respect to their associated circuit board.

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a1 54. (New) The method of Claim 53, wherein moving each spindle and drill bit with respect to their associated circuit board comprises moving the work table.
